California Department of Fish and Game

DRAFT
White Paper

Climate Change-related Research Considerations

Mission Statement

The Mission of the Department of Fish and Game is to manage California's diverse fish, wildlife, and plant resources, and the habitats upon which they depend, for their ecological values and for their use and enjoyment by the public.

July 2008

The California Department of Fish and Game (DFG) is aggressively implementing a strategy to manage the impacts of global climate change on wildlife and habitat. In keeping with its mission, DFG is committed to reducing the effects of climate on the state's natural resources and helping all species to adapt to these changes, many of which are still largely unknown. *California's Wildlife Action Plan* has been adopted and is being put into practice. It identifies climate change as one of four primary stressors affecting wildlife (along with growth and development, water management conflicts, and invasive species) and makes recommendations to incorporate climate change science in our restoration work.

DFG has taken a leadership role among the state fish and wildlife agencies to begin to address the uncertainty associated with our changing climate through landscape-scale efforts that support managing robust populations and healthy habitats – the best way to ensure success in the face of uncertain future. Our staff represents wildlife interests on the climate action-working group of the Western Governor's Association and the Climate Change committee for Association of Fish and Wildlife Agencies (AFWA). There are many targeted efforts under way focused on climate change research, monitoring and other more specific actions.

Along with State Parks, CalFire, and other Resources Agency departments, we have and ongoing process in place with the California Biodiversity Council to build a comprehensive library of published literature, popular articles, and other information on climate change effects that will be made available to the public. We've also developed complementary data and enhanced our close collaboration with sister state agencies to help inform decisions ranging from levee placement to park management to highway interchange locations.

As a Department we've made great progress in a short amount of time and are very committed to addressing climate change in all our activities and by supporting research priorities, including working with partners like the CEC, and being a part of the process on the CAT research subgroup. The Department is also an active member of the Association of Fish and Wildlife Agencies which recently held a special general session on "The Changing Climate of Wildlife Management" and is expected to play a significant role in identifying tools and resources managers will need to address climate change related impacts to wildlife.

The Department intends to leverage internal and external resources to acquire funding necessary to support its research goals. Paramount to this effort is working with partners such as the California Wildlife Foundation (CWF). The CWF is an independent 501(c)(3) nonprofit corporation with a proven record of collaboration with partner organizations to help protect the state's rich diversity of wildlife species. By providing our partners with broad guidance pertaining to our research goals (see below), they will then pursue grants and donations to enable

the Department to meet these goals and to incorporate climate change into our new and on-going activities.

The Department has started a process to create an adaptation strategy within DFG and recently held a seminar and workshop which will provide input on priorities and research needs relative to implementing the California Wildlife Action Plan that should fit well into the effort of the CAT team.
California's Wildlife Action Plan calls for wildlife agencies and land managers to consider the most current projections of climate change effects on wildlife and their habitats during conservation planning and ecosystem restoration. This is one of 11 recommended statewide conservation actions in the plan. Climate change is also identified specifically as a major wildlife stressor in several of the states bioregions in the plan (Sierra Nevada/Cascades, Central Valley /Bay-Delta). Climate change is identified along with growth and development, water management conflicts, and invasive species as having major consequences for species, ecosystems, and habitats in every region of the state.

Wildlife Action Plan implementation efforts will consider the effects of climate change on wildlife. Long-term monitoring and resource assessment will be key components and rely on measures and metrics that can be linked to climate change analysis. As scenarios, models, and projections of climate change on the ground are developed, refined, and ultimately supported by real data, the Department will factor these variables into our conservation strategies, planning, and land acquisition and land management priorities. The intent of this effort is to emphasize solutions for long-term conservation needs.

The Natural Community Conservation Planning (NCCP) program of the Department is an unprecedented effort by the State of California, and numerous private and public partners. An NCCP identifies and provides for the regional or areawide protection of plants, animals, and their habitats, while allowing compatible and appropriate economic activity. The NCCP program is a cooperative effort to protect habitats and species. The program began in 1991 under the State's Natural Community Conservation Planning Act.

NCCP Act section 2820(a)(4)(D) was developed specifically to address the potential for climate change. The intent is that a plans scope would be large enough so that changes in species distribution would not mean it disappears from a planning area entirely, but might shift within it.

However, while the knowledge base of effects on species and ecosystems is expanding, there still is a paucity of practical information on incorporating climate change into the conservation planning and management process at regional and local scales.

To address this growing need will require a state-level vulnerability analysis to produce a spatially-explicit assessment of the impacts of climate change on

California's biological diversity. This will be a very large and complex task given the size and diversity of the state and may be best handled on a bioregion scale. Broad research objectives are:

(1) Prepare an assessment of the vulnerability of species and ecosystems of conservation concern to current and projected future climate change,

(2) Identify science-based adaptation strategies for managing and protecting habitats for native species populations and communities threatened by regional climate change,

(3) Synthesize, interpret and distribute scientific information about known and potential impacts of climate change on the biodiversity of the state to key decision makers such that it is widely incorporated into land and water management policy and practices.

Some of this work has begun in California for specific species groups and/or habitats. The Department needs to play a key role in the oversight of such efforts and the application of their results. The role of good climate science research is essential in the evaluation the vulnerability of the states natural resources, and the development and implementation of effective adaptation strategies for California's biodiversity. The Department's policy on science quality and the key elements of scientific work outlines the approach we will follow in partnership with others to identify and support such research. That document is provided as an attachment to this white paper.

The following examples of impacts to wildlife and ecosystems caused by greenhouse gas buildup and climate change need to be considered in priority research efforts and have significant implications for California's biodiversity:

- Change in timing of water availability and water quality.
- Increase in the frequency and severity of extreme weather events such as storms, heat waves, flooding, and drought.
- Changes in cloud cover and rainfall patterns.
- Changes in the level of snowpack and the timing of their melt.
- Increases frequency and severity of ozone exceedances due in part to changes in photochemistry.
- Sea level rise and acidification of the oceans
- Increased intrusion of seawater into estuaries due to sea level rise.

- Changes in timing of animal and plant life cycles (phenology), and distributions of wildlife populations, separating predators from prey and otherwise disrupting ecological communities.
- Increase in invasive species including pathogens and parasites.

- Altered migration patterns of fish, birds and mammals.
- Changes in forage base by many species.
- Loss or degradation of wetlands.
- Pollution from storm runoff and flooding i.e. silt, sewage, farm chemicals
- Warming of rivers, streams, lakes and estuaries
- Vegetation changes
- Increased frequency and intensity of wildfire
- Increased interactions between two or more of the above.

Each of these disturbances, by itself, poses a serious threat and potentially extinction to numerous plant and animal species. Yet none happens in isolation from the other forces that also threaten species, such as habitat loss and fragmentation, the spread of invasive species and unsustainable harvest of resources for human consumption. Climate change exacerbates the impacts from each of these non-climatic factors to place additional stress on the state's biodiversity.

Priority research is necessary so that managers of wildlife, land and water will have a number of tools to lessen threats to ecosystems and to avert extinctions. Adequate funding is not available to conduct such research now. Research is necessary to develop feasible actions that:

- *Maintain healthy, connected, genetically diverse populations.* Small isolated populations are more prone to local extirpations than larger, more widespread populations. Although managers already encourage healthy populations, global warming increases the importance of this goal and will likely require adjustments in population targets and in the design of habitat corridors including their restoration and maintenance under changing climate conditions.
- *Reduce non-climate stressors on ecosystems.* Reducing other human-induced stressors such as toxic pollution and habitat loss will minimize negative synergistic impacts with global warming and increase the resiliency of habitats and species to the effects of climate change and variability.
- *Prevent and control invasive species.* Rapidly changing climates and habitats may increase opportunities for invasive species to spread. Extensive monitoring

and control will be necessary to limit the negative impacts of invasive species along with an assessment of the likelihood of non-native species invasions.

- *Reduce the risk of catastrophic fires.* Global warming could lead to more frequent fires and/or a greater probability of catastrophic fires. Managers can use prescribed fires and other techniques to reduce fuel load and the potential for catastrophic fires.
- *Protect coastal wetlands and accommodating sea level rise.* Managers can defend against the negative impacts associated with sea level rise through conservation easements and the acquisition of inland buffer zones to provide an opportunity for wildlife to migrate inland.
- *Adjust yield and harvest models.* As fish and wildlife populations respond both directly and indirectly to climate through changes in habitats, their productivity and sustainability may increase or decrease. Managers may need to adapt yield and harvest regulations both in anticipation and response to these changes.
- *Consider climate change models as well as historical data when making projections.* Managers must be aware that historical climate, habitat and wildlife conditions are not indicative of future conditions. Projections and planning should take into account expected changes in climate.
- *Employ monitoring and adaptive management.* Due to uncertainty concerning global warming, wildlife managers must anticipate the impacts to wildlife and use monitoring data to quickly adjust management techniques and strategies. Traditional, long-practiced methods and strategies will not be as effective as conditions change.
- *Identify new opportunities.* Managers must be ready to anticipate and take advantage of new opportunities. For example, if climatic conditions leave existing agricultural areas unusable for agriculture, they could become important wildlife conservation areas with the appropriate agency and landowner collaboration.

In summary, the Department of Fish and Game is committed to minimizing the effects of climate change on the state's natural resources. Climate change science, including new priority research, has a key role in the development of adaptation and mitigation measures, policies, and practices to provide clear benefits to fish and wildlife resources and recognize the uncertainty associated with future climatic states. The Department will work to identify, respond, and prepare for climate change through landscape scale efforts.

California Department of Fish and Game

Strategic Initiative to Expand Scientific Capacity:

Policy for Quality in Science
And
Key Elements of Scientific Work

January 2008

Policy Statement

Given the vital role of science in the management of natural resources, the Department of Fish and Game is dedicated to ensuring that scientific information is developed and used in a responsible and rigorous manner.

The Department of Fish and Game is committed to supporting a quality scientific program that:

…….. is readily demonstrable to all stakeholders, including the scientific community and the public.

Ensuring that DFG's science program is of the highest quality enhances the performance and credibility of its actions. The quality of scientific work is based on the collective view of experts with respect to the veracity and merit of the methodology applied and results achieved. Quality also depends on having adequate resources to carry out the work required.

…….. is relevant from an immediate and a longer-term perspective.

Scientific efforts must be directed at issues that are important to DFG's mission and to stakeholder groups today. Additionally, DFG's science program must extend beyond the immediate concerns of today. It must be able to identify and assess emerging public policy issues that have yet to become public priorities.

…….requires the organization's scientific staff share a responsibility for adhering to the highest ethical standards.

Integrity in science is essential to maintain the respect and confidence of California's citizens and members of the legislature, and to enhance the reputation of DFG's research programs and scientific professionals. DFG staff scientists are expected at all times to uphold the public trust. They are expected to observe the ethical standards established by their own professional organization, and those set by the professional bodies with which they are affiliated.

……..embraces innovation by encouraging creativity and continuous learning.

DFG must embrace the notion of continuous learning and create a climate that values innovative thinking.

…….. is possible only if the organization recognizes that people are fundamental to the ability to deliver on its scientific responsibilities.

DFG values its outstanding scientists, engineers, technicians, and support personnel, and will invest in the resources needed to attract, develop and support them in the performance of excellent work. The ability of the DFG to effectively recruit, develop, recognize and support talented scientific staff will determine its level of success in fulfilling its unique role in managing California's natural resources.

…….. requires leadership and commitment at all levels.

Leadership is needed to build bridges between mandates, to develop and apply consistent processes, and to ensure project quality and completion. Leadership also ensures strong linkages through partnerships, collaboration and integration which will expand the value and reach of DFG's scientific programs.

…….. must function within a clear management accountability framework.

The effective management of any activity requires information about strategic priorities, objectives, inputs, flow of resources, outputs and outcomes. Monitoring of these factors provides the basis for the ongoing evaluation of progress, as well as input into subsequent decision making.

…….requires modern facilities, equipment and networks.

DFG recognizes that state-of-the-art facilities, equipment and networks are required to carry out its responsibilities and will strive to provide them within the means made available to the Department. A modern scientific infrastructure forms the basis of the Department's ability to uphold the integrity of current science programs and to study emerging challenges.

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Key Elements of Scientific Work
Within the Department of Fish and Game

Science Proposals

- Scientific work conducted by or on behalf of DFG will be based on a formal written proposal that receives appropriate supervisory and peer review (see Scientific Peer Review below).
- Proposals for DFG scientific work (Proposals) will provide rationale for the work and linkage to the Strategic Plan, considering both resource management data needs and available scientific information.
- Proposals will state the research and/or natural resource management objectives of the work, linking objectives to the research questions and hypotheses, as well as expected result(s) and utility of the completed work.
- Proposals will include a description of study methods, including: 1) sample sizes and locations; 2) field and laboratory methods, including Quality Assurance/Quality Control procedures; 3) data analysis, including statistical test(s); 4) modeling algorithms, assumptions and parameters and 5) applicable literature references.
- Proposals must address project feasibility, including staffing level, duration, funding, schedule of program assessments and progress reports, permits and other regulatory considerations, health and safety, and staff qualifications. If appropriate, collaborators or technical consultants with additional expertise will be identified.

Results

- Scientific data generated within DFG will be maintained and archived using appropriate media/storage technology, and supported by the appropriate meta-data.
- Scientific work and findings conducted within DFG will at minimum result in written reports and, as feasible, scientific publications. Written reports will be made available to all DFG staff via whatever methods or media considered most appropriate by the researchers and program managers responsible for the work.

Scientific Peer Review

- Written proposals, reports, data sets, and manuscripts (for submittal to a scientific journal) will be peer reviewed by DFG scientists or DFG-selected professionals having education and experience commensurate with the proposal or work under review. High profile proposals or work that has a substantial management impact or large expenditure of funds will be subject to formal independent peer review.

Research Partnerships

- Staff proposing scientific work will seek opportunities for collaboration within DFG as well as with other sectors of the scientific community, natural resource agencies, non-profit institutes, and universities.